

REVISED RANGE DESIGN/CONSTRUCTION INTERFACE STANDARDS

SUPPLEMENT TO CEHNC 1110-1-23

**(POWER AND DATA TRANSFER INTERFACES
SUPERCEDED)**

Prepared by:

U.S. Army Engineering and Support Center, Huntsville

Range and Training Land Program Mandatory Center of Expertise (RTLTP MCX)

<http://www.hnd.usace.army.mil/rtlp>

October 1, 2002

(Revised December 11, 2002)

1.0 EXECUTIVE SUMMARY

1.1 Background

A new automated military training range requires two contractors to complete the construction. The first is responsible for the facilities (MILCON) portion of the construction, (i.e. buildings, earthwork, infrastructure, target emplacements, etc.). The second is responsible for the installation of the targetry system. The break line or 'target interface' between these two contractors is the subject of this document. Since the 1980's, the Army has installed a type classified targetry system, Remoted Target System (RETS), as the standard targetry system. The RETS system is in the process of being replaced by Next Generation Army Target System (NGATS). Beginning with the FY04 MILCON range projects, all future range projects will use the new interface required by NGATS.

The overall intent of the new interface standard is:

- The targetry/command and control system will be Ethernet based.
- Due to extreme weather conditions, a high potential for damage due to the nature of live fire ranges and the avoidance of specialized maintenance activities; downrange infrastructure hardware (i.e., modems, switches, routers, etc.) is avoided if at all possible.
- All ranges (i.e., urban training, armor or infantry) have the same targetry connect/disconnect configuration.
- Maximize the use of commercially available products (COTS) and standards.

1.2 Summary of Report

This report supercedes the interfaces and respective emplacement configurations shown in CEHNC 1110-1-23, U.S. Army Corps of Engineers Design Manual for Remoted Target System (RETS) Ranges. This document represents a solution to power and data transfer requirements prescribed by NGATS using technology available today; it outlines revisions to downrange power distribution, data transfer, the target emplacement itself, and miscellaneous revisions to range standard buildings. Range designs must comply with these interfaces for compatibility with target equipment provided with projects constructed in FY04 and beyond.

2.0 ELECTRICAL

2.1 Background

There are a number of differences in the power requirements between RETS and NGATS. The most visible of which are the change in the voltage of the Stationary Infantry Target (SIT) mechanism from 240V to 120/240V, the increase in the thermal blanket load from 150Watts to 260Watts, and the deletion of the CJB.

2.2 Power Requirements

The power requirement for the NGATS targetry is given in the following table.

EMPLACEMENT TYPE	POWER FEED TYPE	PEAK	STATIC LOAD	DESIGN LOAD
SIT	120/240V, single phase	700VA while raising or lowering target and firing (IHFS) Infantry Hostile Fire Simulator.	50VA	700VA
Thermal Target	120V	260VA	260VA	260VA
SAT	120/240V, single phase	2kW;	100VA	1.8kVA
Thermal Target	120V	1kVA	1kVA	1kVA
MIT	120/240V, single phase	2kVA during movement	50VA	2kVA
MAT	480V, 3 phase, isolated	65kVA** while moving at high speed. (Use 75 kVA transformer, minimum)		100VA
Control Power	120/240V, single phase	100VA constant		
Thermal Target	120V	1.3kVA	1.3kVA	
Total MAT Load				75kVA
Range Control System (RCS)*	120V, single phase	Associated control equipment		5.37kW (ROC, Tower only)
* STRICOM supplied equipment, coordinate during design.				
**Includes bus bar heater loads				

2.3 Downrange Power Distribution

For ranges from 0 to 300 m deep, each lane will be powered individually from the ROC. Targets on ranges greater than 300 m deep will be powered from downrange power centers (PC) located on the range, see Figure 1.

2.4 Target Emplacement Wall Configuration

All conduits and/or cables should enter and exit from the side or rear of the emplacements. This cable routing helps to minimize damage to the cables from range operations and maintenance crews performing berm repair. The power splice box (PSB) houses the main power cable splice that feeds the adjoining loadcenter. The loadcenter contains circuit breakers to provide power to the target, maintenance receptacle, and Target Fiber Panel (TFP) switch/media converter receptacle. The TFP houses the fiber optic splicing, cross-connect panel (MILCON funded). It also provides space for the OPA funded equipment including jumpers. See Figures 2 for typical SIT, Moving Infantry Target (MIT) and Stationary Armor Target (SAT) emplacement elevations. See Figures 3 and 4 for SIT and MIT emplacement plan view, respectively. The attached MAT Power Center Electrical Plan provides details of the Moving Armor Target (MAT) emplacement.

3.0 DATA/COMMUNICATION

3.1 Background

The digital systems being used by today's new fighting force requires the use of a smarter target in order to adequately train and test the individual, crew, or system. Simulation,

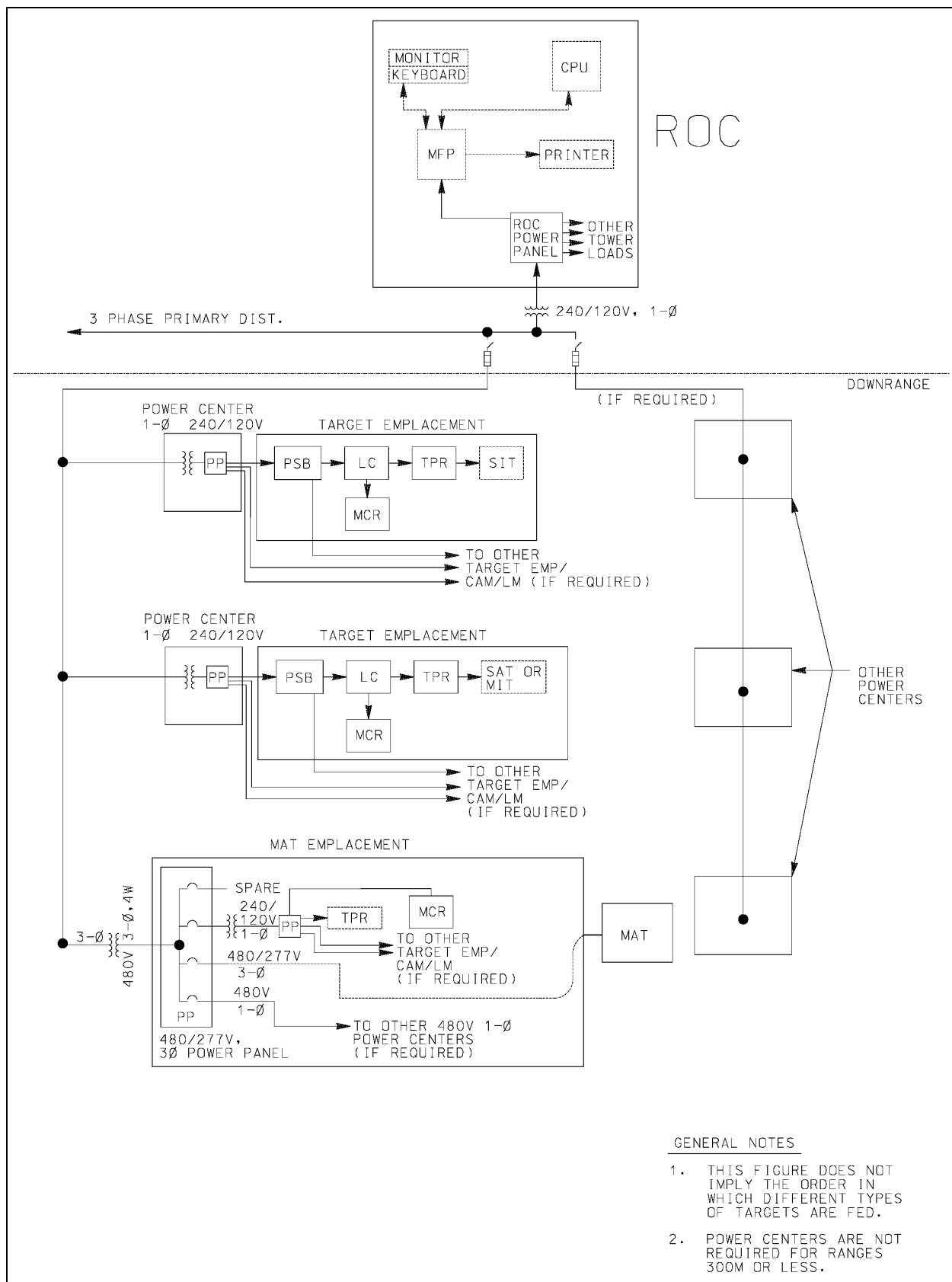


Figure 1 Power Distribution Block Diagram

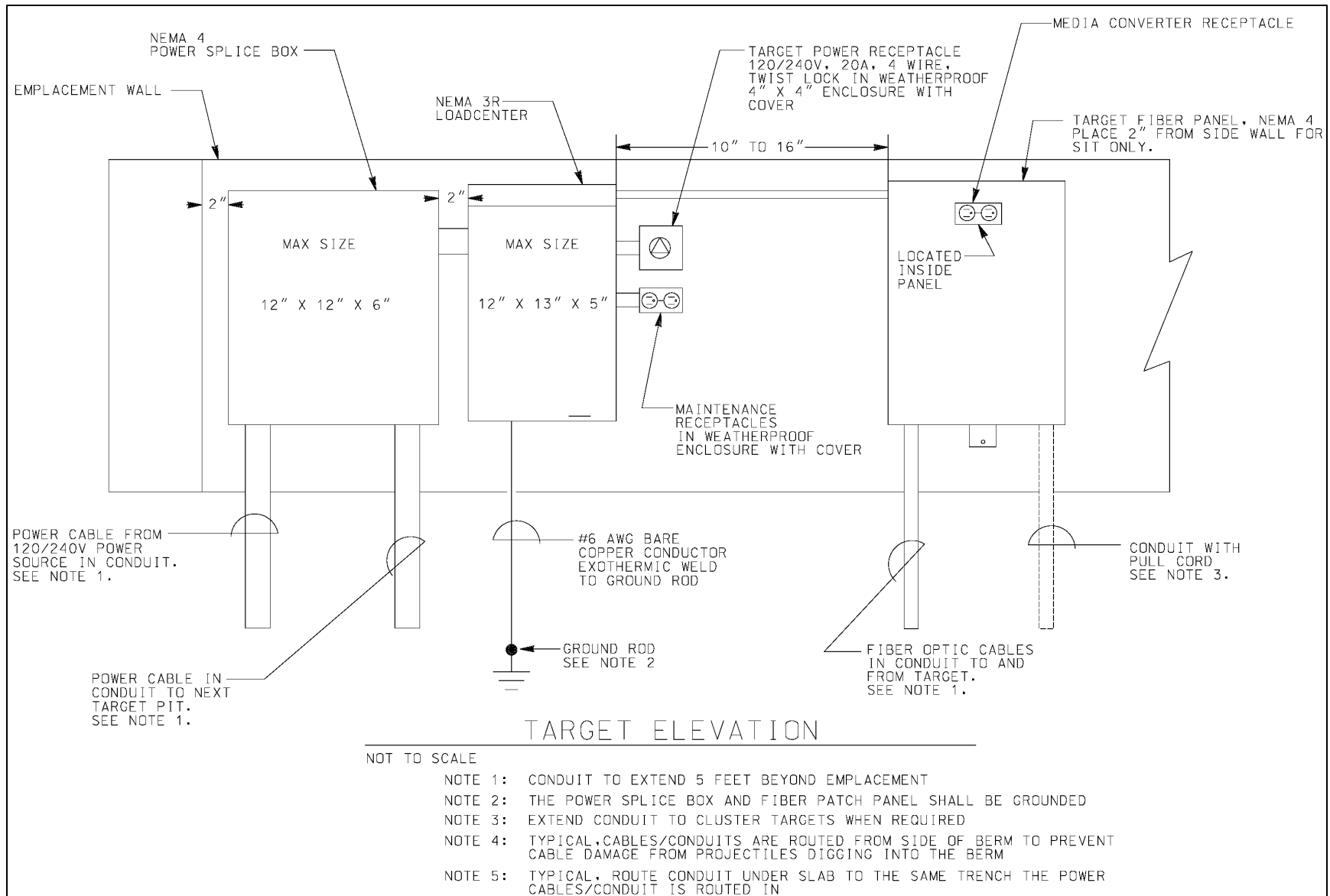


Figure 2 Typical Target Elevation

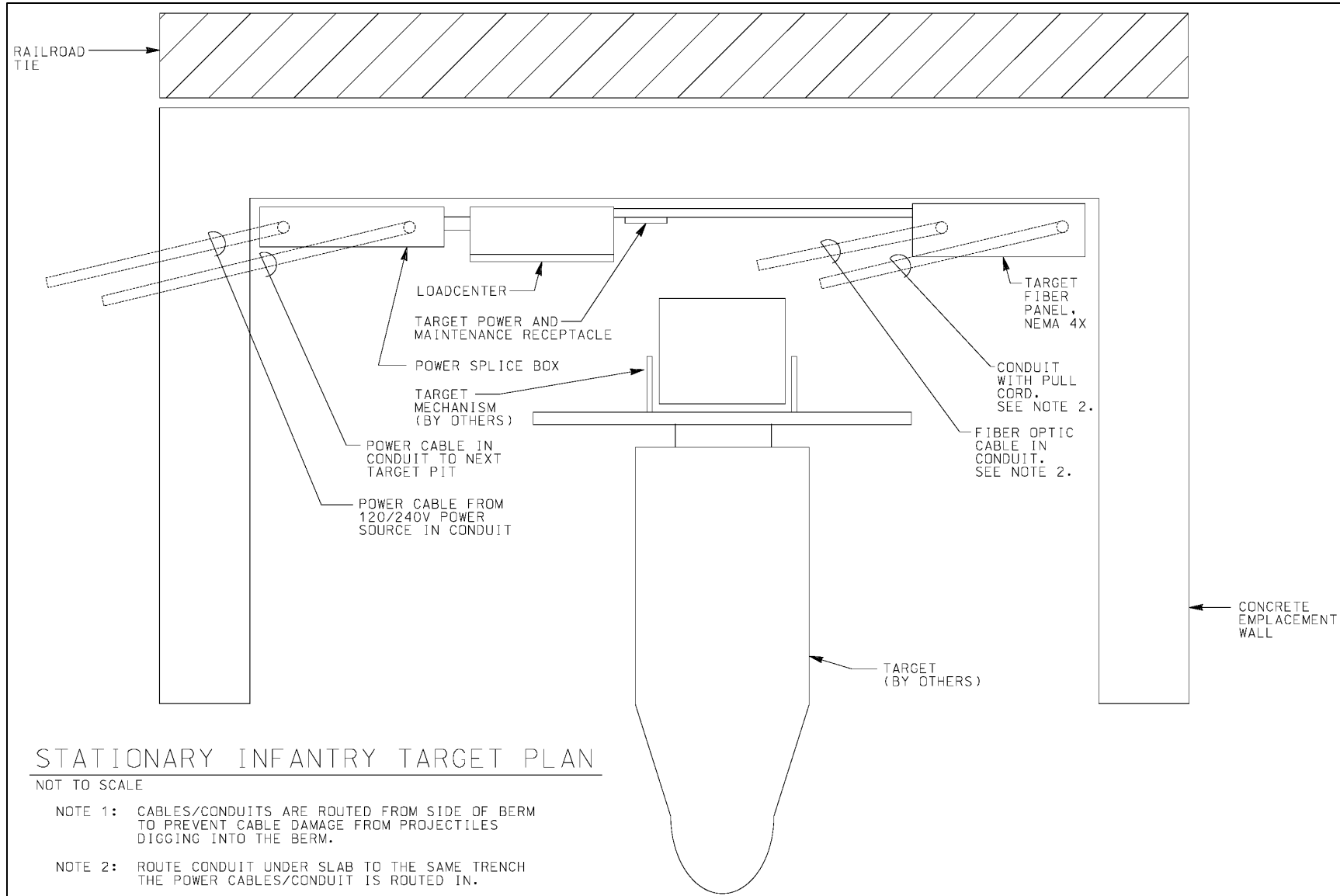


Figure 3

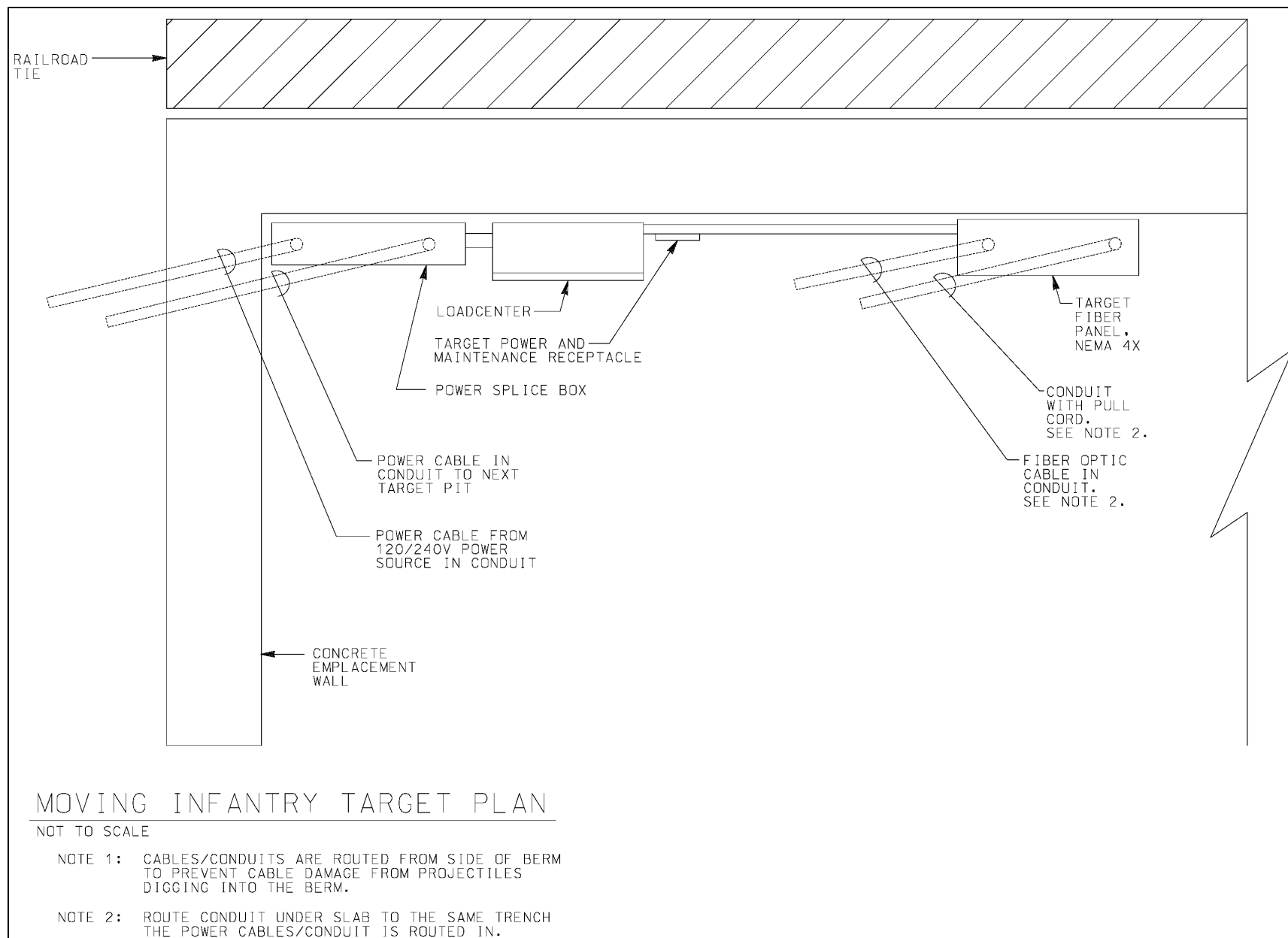


Figure 4

Training, and Instrumentation Command (STRICOM) has determined that an Ethernet protocol is the best solution to meet NGATS data requirements. A digital Ethernet is necessary to comply with the new Common Training Instrumentation Architecture (CTIA) standards of communication. Due to distances on the majority of ranges in the US Army inventory and given today's technology, a fiber optic solution was determined to be the most effective media for network construction. The infrastructure provided by MILCON construction is based on installing and terminating a fiber optic cable between a fiber termination rack (FTR) in the ROC and a TFP in each target emplacement. This allows the MILCON contractor to build and test a complete infrastructure system. It also allows the target provider to have equipment flexibility on both target and control ends of the system. See Figure 5.

3.2 Data/Communication Requirements

The following table reflects network requirements for the Ethernet/optical fiber network backbone (from ROC to emplacement).

Target Data Communication Standards

Data Network Requirements

	Speed	Bandwidth	Wavelengths
Ranges over 300m Single-Mode fiber	Min 10Mbps	Unlimited	1310 to 1550nm
	Max Unlimited		
Ranges 300m and under Multi-Mode fiber	Min 10Mbps	Min 200Mhz-km	850nm
		Min 500Mhz-km	1300nm

3.3 Range Operations Center (ROC) Connection

The fiber optic cables will enter the ROC building via conduit filled with innerduct to facilitate future expansion. The cable will then terminate in the FTR. The FTR is an enclosed fiber equipment rack with all fiber optic cables terminated with industry standard type SC connectors to facilitate connection by targetry system installer for instrumentation purposes. See Figure 6. The MILCON contractor is responsible for providing the conduit, fiber, rack, and cross-connect panel.

3.4 After Action Review (AAR) Connection

The fiber optic connection between the AAR and the ROC will enter the AAR building via conduit filled with innerduct to facilitate future expansion. The cable will then terminate in the intermediate cross-connect panel (IC). The IC is an enclosed fiber equipment rack with vertical and horizontal cable management.

3.5 Downrange Data Distribution

Direct burial armored fiber optic cable will be used and should be installed in the same trench as the power cable with a minimum 12" separation. Use 6-strand multi-mode or single-mode

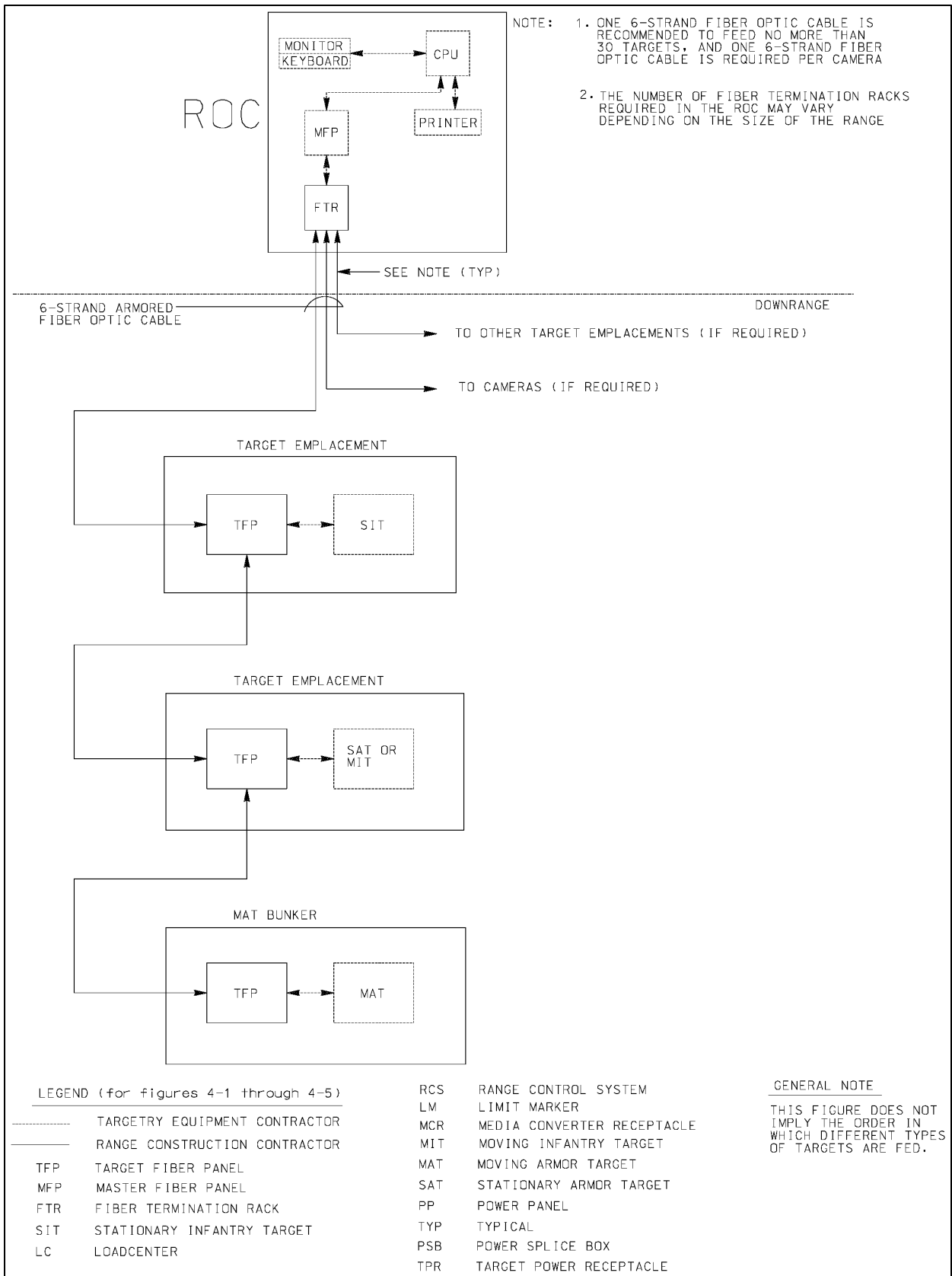


Figure 5 Data Distribution Block Diagram

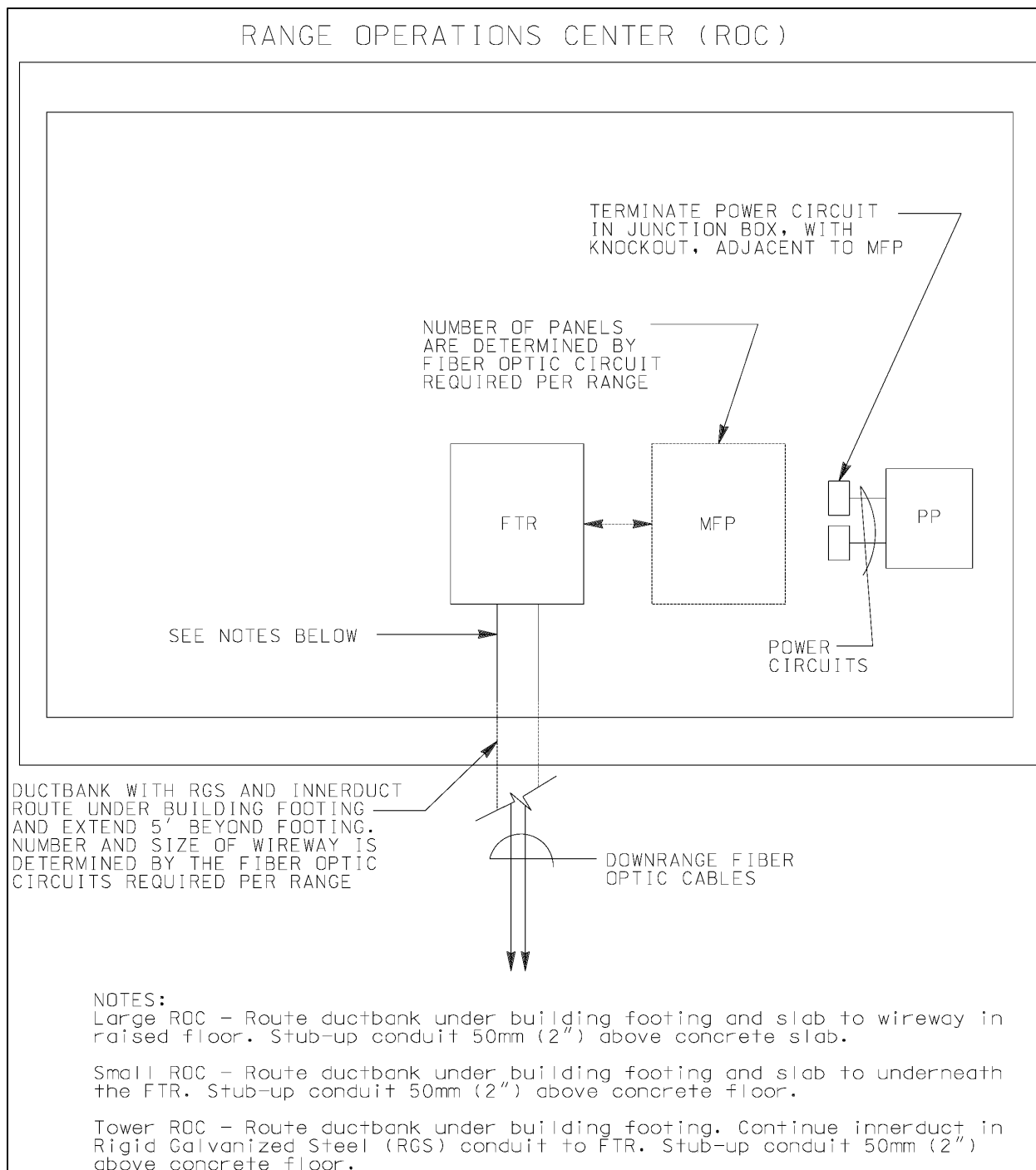


Figure 6 Range Operations Center (ROC) Interface (Power and Data)

armored fiber optic cable that serves a maximum of 30 targets. Contact the RTLTP MCX at the US Army Engineering and Support Center, Huntsville, <http://www.hnd.usace.army.mil/rtlp>, if this limit needs to be exceeded. The fiber optic cable uses the power center as a common routing point when laying it in the trench to the determined daisy-chained emplacement locations. All conduits and/or cables will enter and exit from the side or rear of the emplacements and terminate in the TFP.

4.0 CIVIL

4.1 Background

To support the new NGATS target and interface equipment the target emplacements have been evaluated to ensure that all equipment will fit into and be adequately protected by the emplacement structure and protective berm.

4.2 Emplacement Configuration Revisions

Drawings showing the standard target emplacements are included as attachments to this document. The following is a summary of the major changes.

4.2.1 SIT: The SIT emplacement front wall height changes to a minimum of 457mm (18 inches) in order to provide adequate protection for the equipment enclosures mounted on the front wall. The wall height is valid for angles of fire between 0° and approximately 20°. If the range has a greater angle of fire, the designer will have to calculate the wall height.

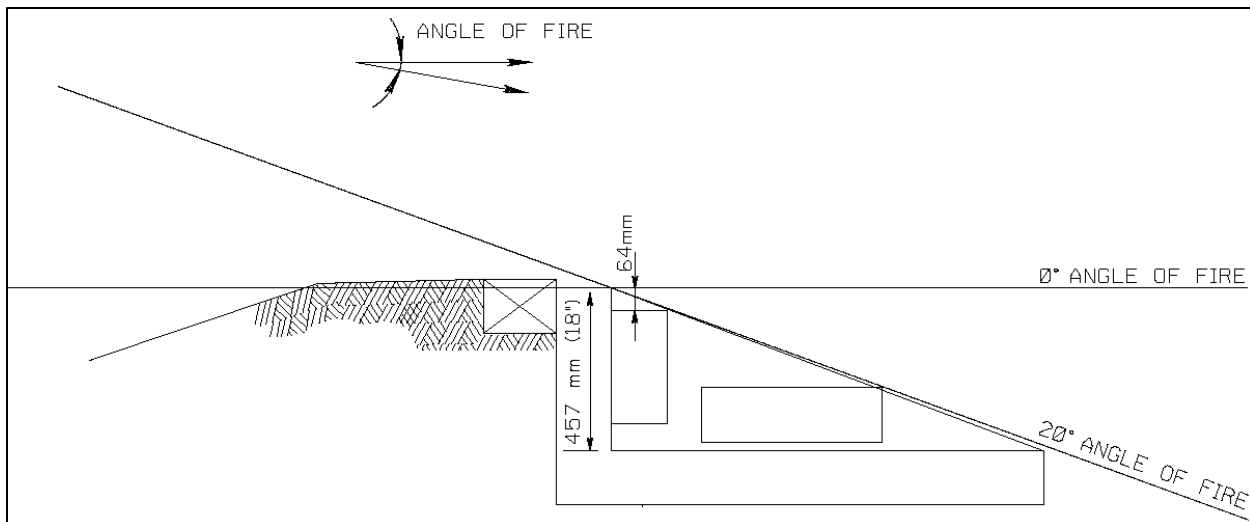


Figure 7 Wall Height Analysis Diagram

4.2.2 MIT: A similar analysis of wall height and angle of fire performed for SIT emplacements (see Figure 7 above) was also performed for MIT emplacements. The analysis yielded a maximum angle of fire of 11° for the standard 660mm (26-inch) wall height. If the range has a greater angle of fire, the designer will have to calculate the wall height.

4.2.3 SAT: The SAT emplacement is essentially unchanged. See the attached drawing for minor revisions. The designer also has the option of using the arrowhead configuration.

4.2.4 MAT: Numerous changes have been made to the standard details to reduce cost and to incorporate “lessons learned”. See the attached drawings.

4.2.4.1 Moving Target Carrier Tracks: The responsibility for installing the tracks and ballast for the target carrier has been shifted from the target provider to the MILCON contractor. Past interfaces have resulted in inadequate materials for the target provider to complete the work. This approach should alleviate that problem and provide a smoother transition between the two Government contractors. Also, the MILCON contractor will have to warranty the entire emplacement versus the finger pointing which happened previously.

5.0 URBAN COMBAT TRAINING FACILITIES

With respect to this document, urban combat training facilities include the Urban Assault Course (UAC), Live Fire Exercise Shoothouse, and Combined Arms Collective Training Facility (CACTF).

5.1 Background

With the exception of the Grenadier Gunnery station on the UAC, urban combat ranges use a different type of target than the other automated ranges. Urban terrain requires much closer interaction between the soldier and the environment. This requires that the targetry, both friend and foe, be more realistic. The Combined Arms MOUT Task Force (CAMTF) has prescribed the use of 3-dimensional precision targets. These targets are not permanently positioned in an emplacement. Rather, they only require a power outlet and a data connection. The target can then be placed as necessary for the scenario, depending on the length of the cords. The MILCON contractor is responsible for the wiring and installation of the power outlets and the data connection on the Shoothouse and CACTF. The Target Power Outlet (TPO) and Target Data Outlet (TDO) are shown in Figure 8.

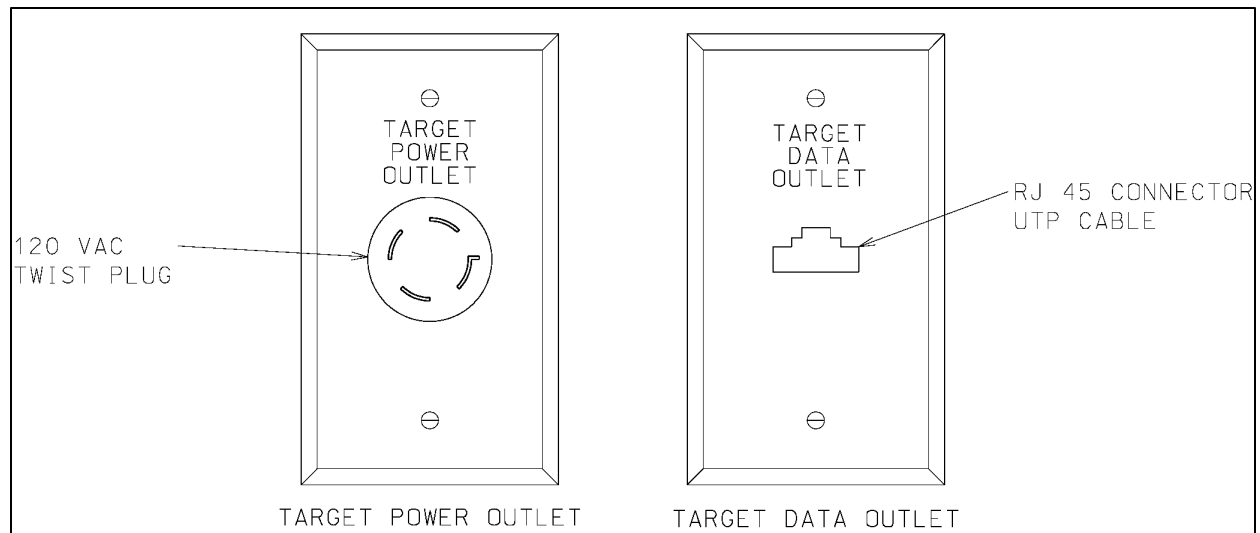


Figure 8

The Shoothouse and CACTF also have a number of cameras in and around the buildings that are used to operate the range, for after action review, and for range safety. The MILCON contractor is responsible for installing the appropriate connectors and required cabling. He must also provide a standard 120VAC duplex outlet next to the camera outlet location. The Camera Outlet is shown in Figure 9.

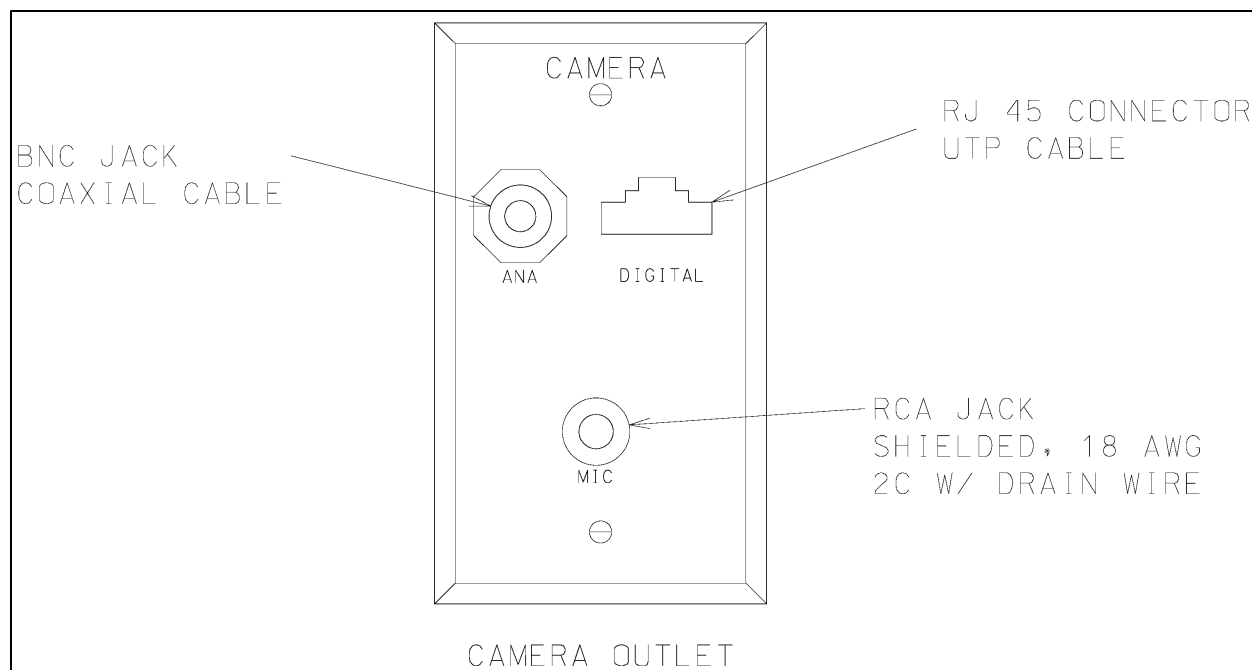


Figure 9

5.2 Combined Arms Collective Training Facility (CACTF)

5.2.1 Power Distribution

120V power will be supplied to each camera and target location from a 120/240V, multi-wire, branch circuit panelboard. The panelboards are generally located inside the electrical/communication room in each building.

5.2.2 Data Distribution

The data distribution system consists of a fiber optic backbone between the buildings and the ROC. Distribution is then routed from the horizontal cross-connect panel in each building's electrical/communication room via copper network to each TDO and camera outlet.

5.3 Live Fire Exercise Shoothouse

Both power and data systems are distributed similar to the CACTF. The Shoothouse is treated the same as one CACTF building. Because the Shoothouse does not have a ROC, a horizontal cross-connect panel is located just outside of the shoothouse from which the copper network feeds the individual TDO's and camera outlets. A fiber connection is then made to the After Action Review Building. The 120V power is fed to each TPO and camera location from a panelboard located outside of the shoothouse.

5.4 UAC

The UAC uses both types of automated targets. Stations 1, 2 and 4 (Individual and Team Task-Technique, Squad and Platoon Task-Technique, and Urban Offense/Defense Building) use the same 3-dimensional precision targets as the CACTF and Shoothouse. Station 3 (Grenadier Gunnery) uses the same pop-up silhouette targets in target emplacements (SIT) that are used on the conventional ranges. Station 5 (Underground Trainer) does not have any targetry. Stations 1, 2, and 3 are designed for live-fire training.

5.4.1 Power Distribution

Each of stations 1, 2, and 3 has a panelboard located at their respective pedestals at the baseline. Station 4 has the panelboard located in the electrical room inside the building. 120V power is distributed to each TPO on Stations 1, 2, and 4 and to each SIT emplacement on Station 3.

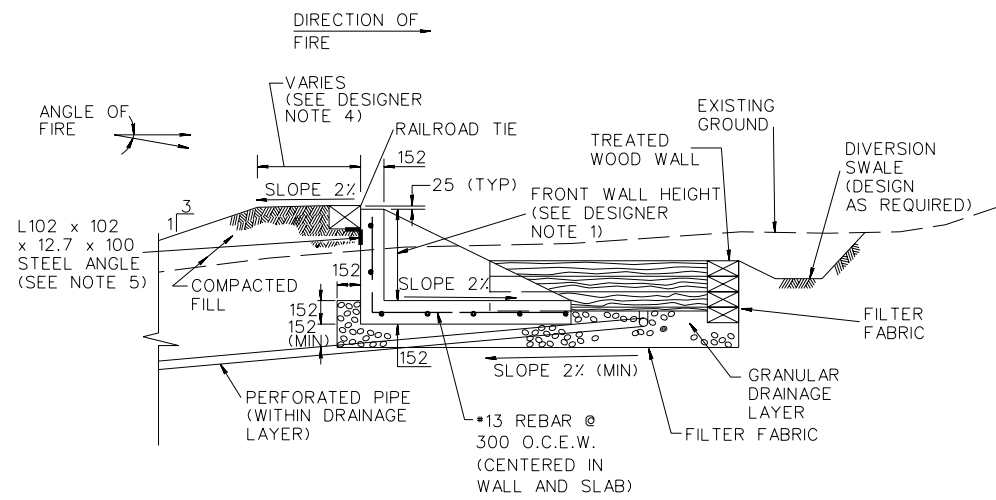
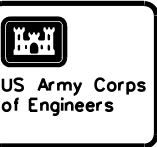
5.4.2 Data Distribution

The current standard UAC does not include any data distribution system. The targets are controlled using a hand-held RF targetry controller. Each station on the UAC must be able to be operated independently and there is no data collection requirement. As an option, a hardwired data system may be included. Such a system would use toggle switches at the pedestal. The design of any optional system must be coordinated with STRICOM and ATSC as it will affect the amount of OPA funding.

6.0 DRAWINGS

Drawings are also available upon request in a .dgn format. Contact the RTLP MCX at RTLP@HND01.usace.army.mil, (256) 895-1534, for assistance.

- Sheet C-1, Stationary Infantry Target Emplacement
- Sheet C-2, Stationary Infantry Target/Infantry Hostile Fire Simulator Emplacement
- Sheet C-3, Moving Infantry Target Emplacement
- Sheet C-5, Stationary Armor Target Emplacement
- Sheet C-6, Moving Armor Target Emplacement
- Sheet A-01, Range Operations Center (ROC) Tower
- Sheet A-02, Range Operations Center (ROC) Small
- Sheet A-03, Range Operations Center (ROC) Large
- Sheet A-11, After Action Review (AAR) Small
- Sheet A-12, After Action Review (AAR) Large
- MAT Power Center Electrical Plan

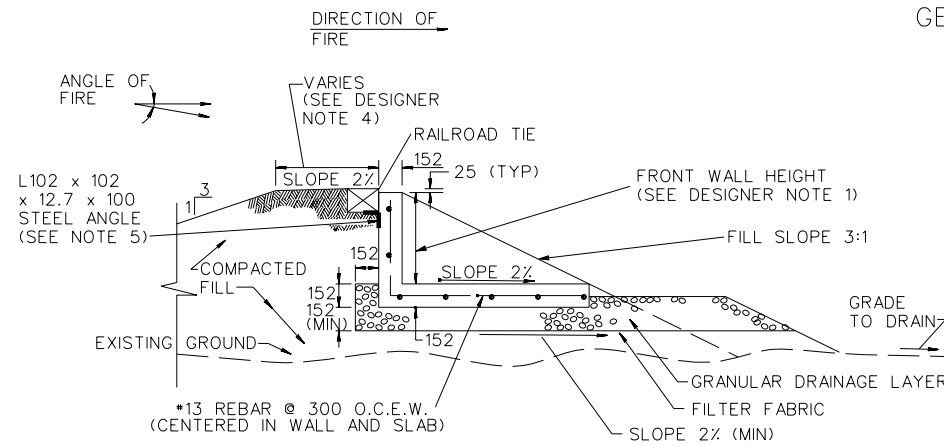


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SECTION _____

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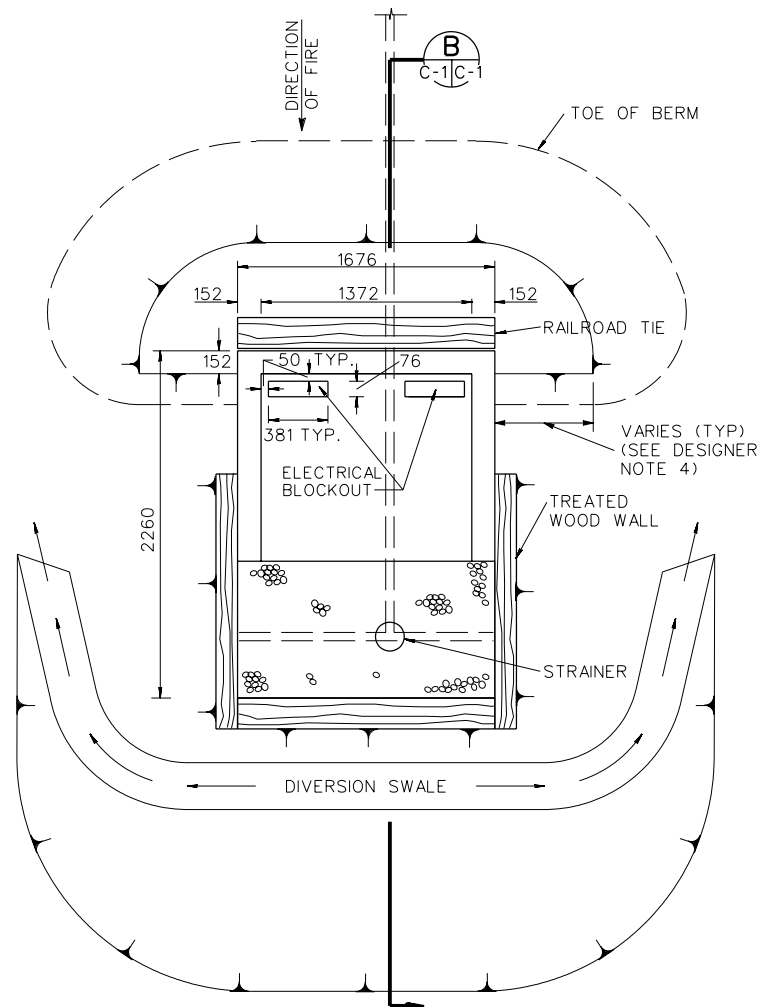
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C-1 | C-

GENERAL NOTES:

1. CONCRETE SHALL DEVELOP A MINIMUM COMPRESSIVE STRENGTH OF 28 MPa IN 28 DAYS.
2. EMBANKMENTS SHALL BE CONSTRUCTED OF REINFORCED CONCRETE; CONCRETE STRUCTURES SHALL BE PRECAST OR CAST-IN-PLACE.
3. ALL REINFORCING STEEL SHALL BE PER ASTM A615, GRADE 60.
4. AREAS DISTURBED BY CONSTRUCTION ACTIVITIES SHALL BE REVEGETATED OR RESURFACED CONSISTENT WITH THE NATURAL SURROUNDINGS. GROUND COVER SHALL NOT REDUCE TARGET VISIBILITY.
5. PLACE RAILROAD TIES AGAINST CONCRETE WALL ON 102x102 x 12.7mm x 100mm STEEL ANGLES SPACED A MAXIMUM OF 900mm ON CENTER. ATTACH ANGLE TO CONCRETE WALL WITH CONCRETE ANCHORS.
6. ALL DIMENSIONS ARE mm UNLESS OTHERWISE INDICATED.

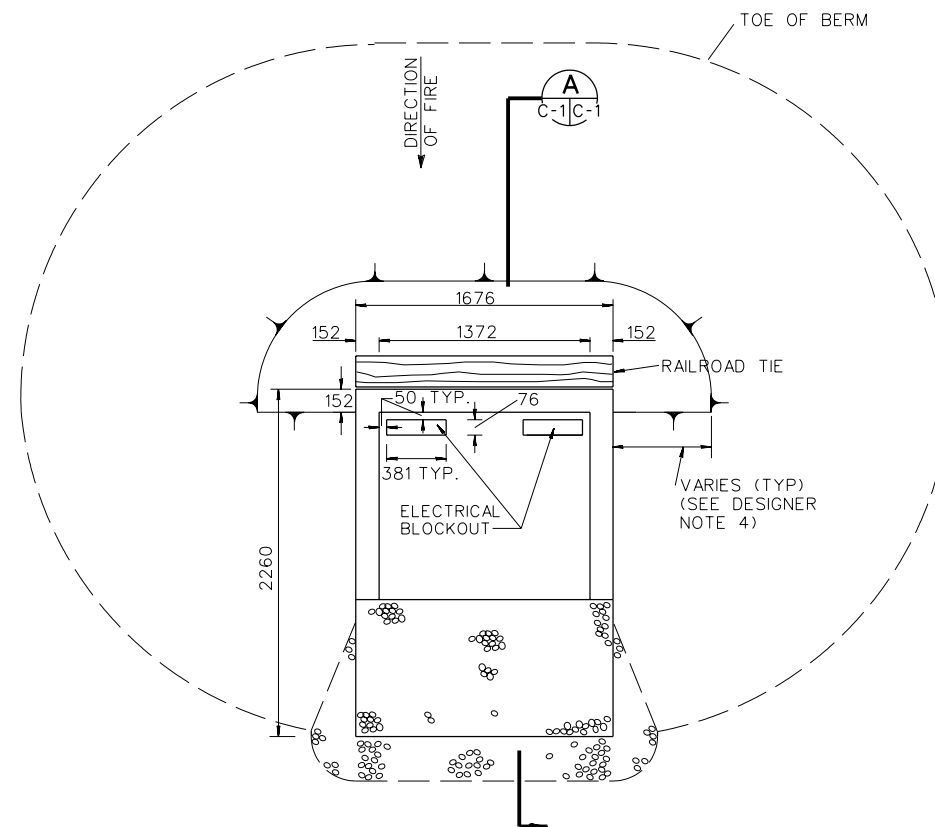
NOTES TO DESIGNER:

1. MINIMUM FRONT WALL WALL HEIGHT IS 457 mm FOR ANGLES OF FIRE UP TO 20°. WALL HEIGHT WILL HAVE TO BE CALCULATED FOR ANGLES OF FIRE GREATER THAN 20°. IF THE TARGET MECHANISM IS TO BE ELEVATED, THE REQUIRED FRONT WALL HEIGHT SHOULD BE INCREASED BY THE DISTANCE BETWEEN THE BOTTOM OF THE MECHANISM AND THE TOP OF THE CONCRETE SLAB.
2. RETAINING WALLS SHALL BE CONSTRUCTED OF ADEQUATELY CONNECTED TIMBERS OR RAILROAD TIES (MAY BE PREFABRICATED). FILTER FABRIC SHALL BE INSTALLED BEHIND ALL WOOD RETAINING WALLS. FABRIC SHALL EXTEND THE FULL HEIGHT OF THE WALL.
3. THE DESIGNER SHOULD USE THE BELOW GRADE EMPLACEMENT DESIGN TO PROVIDE MORE REALISTIC TRAINING, IF THE SITE CONDITIONS ARE ADEQUATE TO SUPPORT POSITIVE DRAINAGE OF THE TARGET EMPLACEMENT. THE TOP OF THE SUBGRADE SHOULD HAVE A MINIMUM LONGITUDINAL SLOPE OF 2% TOWARD THE FRONT OF THE EMPLACEMENT.
4. REFER TO THE BERM THICKNESS FIGURES LOCATED IN THE DESIGN MANUAL TO DETERMINE THE REQUIRED BERM THICKNESS.
5. BERM SLOPES SHOWN AS 3:1 ARE TYPICAL. DIFFERENT SLOPES MAY BE REQUIRED BY SITE SPECIFIC GEOTECHNICAL REPORT.



PLAN
ASCENDING SLOPE OR
BELOW GRADE EMPLACEMENT

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PLAN
SURFACE / FILL EMPLACEMENT
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STATIONARY INFANTRY TARGET EMPLACEMENT

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STATIONARY INFANTRY
TARGET EMPLOYMENT



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5. PLACE RAILROAD TIES AGAINST CONCRETE WALL ON L102x 102 x 12.7mm x 100mm STEEL ANGLES SPACED A MAXIMUM OF 900mm ON CENTER. ATTACH ANGLE TO CONCRETE WALL WITH CONCRETE ANCHORS.
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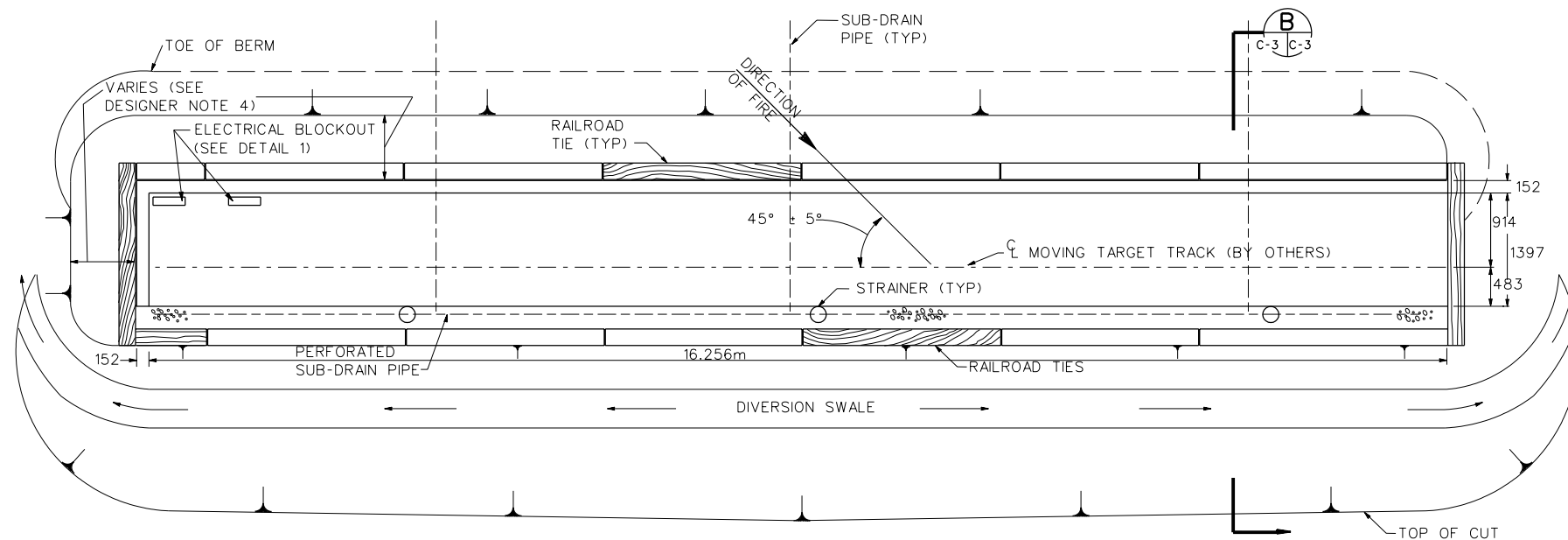
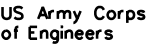
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RANGE AND TRAINING LAND PROGRAM STANDARD DESIGN MANUAL

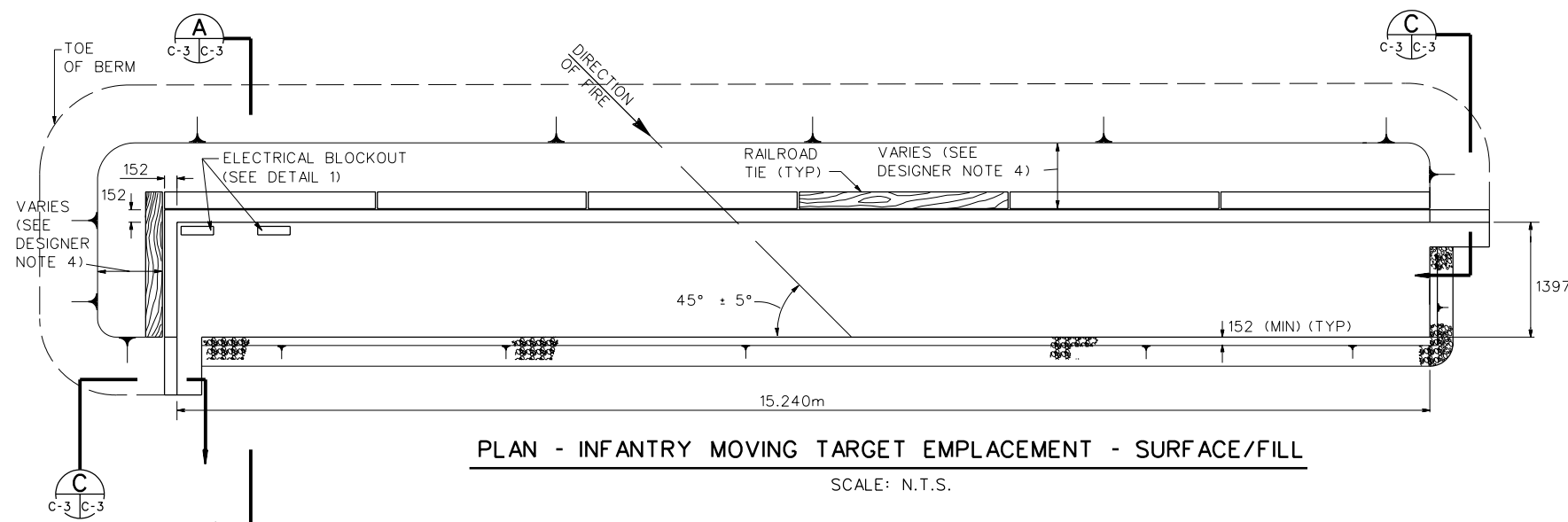
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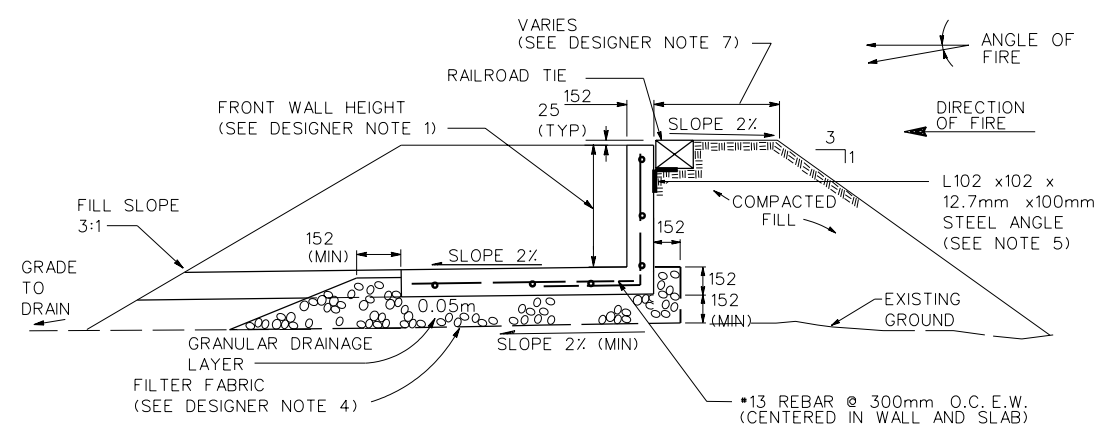
PLAN - INFANTRY MOVING TARGET EMPLACEMENT - ASCENDING SLOPE OR BELOW GRADE

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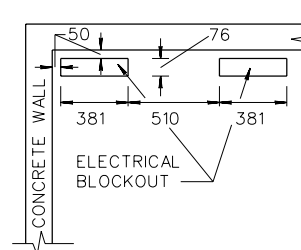
PLAN - INFANTRY MOVING TARGET EMPLACEMENT - SURFACE/FILL

SCALE: N.T.S.



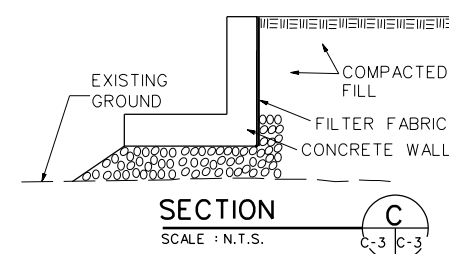
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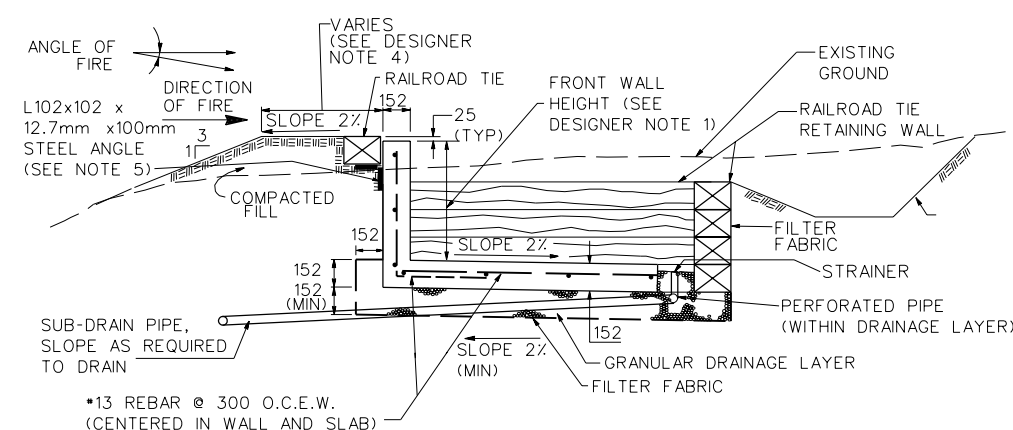
DETAIL 1
ELECTRICAL BLOCKOUT DETAIL

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SECTION

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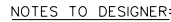
SECTION

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 6. ALL DIMENSIONS ARE mm UNLESS OTHERWISE INDICATED.
 7. THE EMBLEMENT MAY BE REVERSED OR MIRRORED FROM WHAT IS SHOWN HERE. IN ANY CASE, THE PROTECTED END OF THE EMBLEMENT IS ALWAYS NEARER TO THE FIRING POINT AND THE ELECTRICAL BLOCKOUT IS ON THE PROTECTED END.

NOTES TO DESIGNER:

1. MINIMUM FRONT WALL HEIGHT IS 660mm FOR ANGLES OF FIRE UP TO 11°. WALL HEIGHT WILL HAVE TO BE CALCULATED FOR ANGLES OF FIRE GREATER THAN 11°. IF THE TRACK IS TO BE ELEVATED, THE REQUIRED FRONT WALL HEIGHT SHOULD BE INCREASED BY THE DISTANCE BETWEEN THE BOTTOM OF THE TIE AND THE TOP OF THE CONCRETE SLAB.
2. FOR LOCATIONS REQUIRING DIRECTION OF FIRE OF 45°-5° FROM RIGHT OF TRACK CENTERLINE, PLANS AND SECTIONS SHOULD BE ANNOTATED FOR CONSTRUCTION IN A MIRROR IMAGE CONFIGURATION TO THAT SHOWN, WITH THE CJB BEING PLACED AT THE END OF THE EMPLACEMENT NEAREST TO THE FIRING POSITION.
3. THE DESIGNER SHOULD USE THE BELOW GRADE EMPLACEMENT DESIGN TO PROVIDE MORE REALISTIC TRAINING, IF THE SITE CONDITIONS ARE ADEQUATE TO SUPPORT POSITIVE DRAINAGE OF THE TARGET EMPLACEMENT. THE TOP OF THE SUBGRADE SHOULD HAVE A MINIMUM LONGITUDINAL SLOPE OF 2% TOWARD THE FRONT OF THE EMPLACEMENT.
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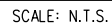


1. REFER TO THE BERM THICKNESS FIGURES LOCATED IN THE DESIGN MANUAL TO DETERMINE THE REQUIRED BERM THICKNESS.
2. THE HEIGHT OF THE MAT BERM IS MEASURED FROM THE TOP OF SUBGRADE THIS DIMENSION MUST BE MAINTAINED.
3. BALLAST SHALL CONFORM TO AMERICAN RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION (AREMA) REQUIREMENTS FOR *57 BALLAST.
4. ALL RETAINING WALLS MUST BE DESIGNED USING SITE SPECIFIC GEOTECHNICAL DESIGN PARAMETERS OBTAINED FROM A SUBSURFACE INVESTIGATION. RETAINING WALLS MAY BE CONSTRUCTED OF TREATED TIMBERS, RAILROAD TIES, CAST-IN-PLACE CONCRETE OR PRECAST CONCRETE. THE WALL SHALL BE DESIGNED SUCH THAT THE TOP 300mm (MIN) OF THE WALL CAN BE REMOVED AND REPLACED IN SECTIONS.
5. MOVING ARMOR TARGET EMBLEMENTMENT MAY BE CONSTRUCTED IN A MIRROR IMAGE CONFIGURATION TO THAT SHOWN.
6. BERM SLOPES SHOWN AS 3:1 SLOPES MAY VARY AS REQUIRED BY SITE SPECIFIC GEOTECHNICAL REPORT.
7. RAILROAD CROSSTIES SHALL BE SPACED AT 3.05m ON CENTER FOR STRAIGHTAWAYS AND AT 1.52m ON CENTER FOR CURVES.

SCALE : N.T.S.



1. CONCRETE SHALL DEVELOP A MINIMUM COMPRESSIVE STRENGTH OF 28 MPa IN 28 DAYS.
2. ALL REINFORCING STEEL SHALL BE PER ASTM A615, GRADE 60.
3. IF RETAINING WALLS ARE CONSTRUCTED OF TREATED TIMBERS OR RAILROAD TIES, FILTER FABRIC SHALL BE INSTALLED BEHIND THE WALLS. FABRIC SHALL EXTEND THE FULL HEIGHT OF THE WALL.
4. AREAS DISTURBED BY CONSTRUCTION ACTIVITIES SHALL BE REVEGETATED OR RESURFACED CONSISTENT WITH THE NATURAL SURROUNDINGS. GROUND COVER SHALL NOT REDUCE TARGET VISIBILITY.
5. ELECTRICAL TRANSFORMER PAD SIZE SHALL BE OBTAINED FROM ELECTRICAL CONTRACTOR.
6. SLOPE WALL AT A 3:1 SLOPE TO A POINT 300mm ABOVE THE EXISTING GRADE.

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Reviewed by:		Drawing code:
Submitted by:		File name: Plot date: Plot code:

U. S. ARMY ENGINEERING AND
SUPPORT CENTER, HUNTSVILLE
HUNTSVILLE, ALABAMA

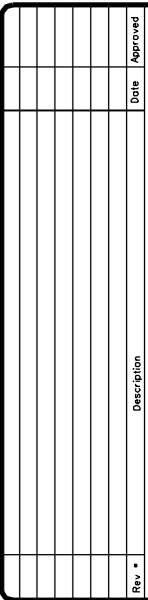
RANGE AND TRAINING LAND PROGRAM STANDARD DESIGN MANUAL

MOVING ARMOR TARGET EMPLOYMENT

Sheet
reference
number:

C-6

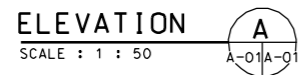
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SCALE : 1 : 50



SCALE : 1 : 50



The Range Operations Center (ROC) Tower provides office space for personnel conducting training exercises and space for the installation of the required electronics and communications equipment. The control room requires an area of 23 square meters (248 square feet). An optional observation platform can be constructed below the control room, enclosure of this level is also an option. The occupant load factor is 9.3 net sq. meters (100 sq. feet) (per person) based on a business use. See NFPA 101 table 7.3.1.2. The height of the tower is based on providing line of sight to the firing line and down range areas where required. All dimensions not labeled are in millimeters.

This standard definitive design should be adapted to local conditions such as climate, available construction materials and techniques, topography, seismic zone and the existing character of surrounding buildings. These factors may affect plans, elevations and building systems. The building foundation must be designed based on the results of a geotechnical investigation.

The design and construction must comply with applicable codes and standards including: technical instruction TI 800-01, "Design Criteria"; Department of the Army regulations, technical manuals, handbooks, standards, and specifications; IBC, NEMA, ANSI, UL, ASTM, and NFPA standards.

A work surface is provided for monitors, computers, printers and associated equipment. Windows are fixed and horizontal sliding to meet functional requirements. Provide polycarbonate security glazing in the door. Ice guards may be necessary in northern climates. The tower is accessed only by able-bodied personnel and does not require ADA compliance unless dictated by local criteria.

The Mechanical Equipment shall be selected and sized based on site requirements, local weather design criteria, available energy sources, and building construction materials. The mechanical system must maintain an equipment operating temperature of 16 C to 27 C (60 F to 80 F). U-Factor requirements are based on the local climatic conditions in accordance with TI 800-1. Provide a drain to prevent condensate dripping on observation level and stairs below.

The Tower shall be served by 20/240V, 1 phase, 3-wire secondary power. Rigid Steel conduit shall extend a minimum of 1524mm (5') outside of the building foundation for power and communication circuits entering and leaving the building. Voltage drop shall comply with standards in NEC and Army technical manuals. Grounding will be installed in accordance with NFPA 70, the NEC, and other applicable standards.

The panelboards shall be recess mounted in finished areas. Receptacles shall be general purpose, 120V, 20A Duplex mounted 450mm (18") above the finished floor. All outlets, receptacles, and conduit shall be recess mounted in finished areas. Provide 20/240V power for the HVAC unit.

Illumination levels will be designed in accordance with IES. Interior lighting shall consist of fluorescent lamps at a level of 50 foot-candles. Incandescent fixtures with red lamps on separate switching shall be placed near each fluorescent lamp in the Control Room and on exterior walls of entrance. Exterior lighting shall be provided with separate switching located near points of egress.

The emergency electrical system shall comply with NFPA 70 and NFPA 101. Emergency lighting shall be provided to ensure adequate illumination to egress building in the event of a power outage.

Lightning protection is required for this building in the form of either mast protection or air terminals on the building.

Telephone service is not a requirement for range operations. However, service should be provided to the ROC if it is available in the area.

A fiber optic connection is required between the ROC and the AAR.

Fire protection is not required per fire codes for this building. Consult local Fire Marshall for compliance with local requirements.

1:50 1000 500 0 1000 2000



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[illegible]

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U. S. ARMY ENGINEERING AND
SUPPORT CENTER, HUNTSVILLE
HUNTSVILLE, ALABAMA

RANGE AND TRAINING LAND PROGRAM
STANDARD DESIGN MANUAL
RANGE OPERATIONS CENTER (ROC)
SMALL

Sheet
reference
number:

A -02

The Range Operations Center (ROC) provides office space for personnel conduct training exercises and space for the installation of required electronics and communications equipment. The control area and equipment area each require 37.2 square meters (400 square feet) for a total of 74.3 square meters (800 square feet). The occupant load factor is 9.3 net sq. meters (100 sq. feet) (per person) based on a business use. See NFPA 101 table 7.3.1.2. All dimensions not labeled are in millimeters.

This standard definitive design should be adapted to local conditions such as climate, available construction materials and techniques, topography, seismic zone and the existing character of surrounding buildings. These factors may affect plans, elevations and building systems. The building foundation must be designed based on the results of a geotechnical investigation.

The design and construction must comply with applicable codes and standards including: technical instruction TI 800-01, Design Criteria; Department of the Army regulations, technical manuals, handbooks, standards, and specifications; IBC, EMA, ANSI, UL, ASTM, and NFPA standards.

A work surface is provided for monitors, computer, printers and associated equipment. Where topography allows viewing down range from the control room, windows can be placed above the counter. Windows are double hung to meet functional requirements providing viewing, natural light and ventilation. Windows have forced entry resistant metal frames and are provided with insect screens. Floor and front of window frames are finished with vinyl tile. Floors should be sealed concrete or vinyl tile for ease of cleaning, with gyp. board ceilings. Gutters, downspouts and splash blocks should be provided where required by climatic conditions. Covered entries and ice guards may be necessary in northern climates. The RUC is accessed only by authorized personnel and does not require ADA compliance unless dictated by local criteria.

The Mechanical Equipment shall be selected and sized based on site requirements, local weather design criteria, available energy sources, and building construction materials. The mechanical system must maintain an equipment operating temperature of 16 C to 27 C (60 F to 80 F) in the control room. U-Factor requirements are based on the local climatic conditions in accordance with TI 800-1.

The RDC shall be served by 120/240V, 1 phase, 3-wire secondary power. Rigid Steel conduit shall extend a minimum of 1524mm (6') outside of the building foundation for power and communication circuits entering and leaving the building. Voltage drop shall comply with standards in NEC and Army technical manuals. Grounding will be installed in accordance with NFPA 70, the NEC, and other applicable standards. The panelboards shall be recess mounted in finished areas. Receptacles shall be general purpose, 120V, 20A Duplex mounted 450mm (18") above the finished floor. All outlets, receptacles, and conduit shall be recess mounted in finished areas. Provide 120/240V power for the HVAC

illumination levels will be designed in accordance with IES. Interior lighting shall consist of fluorescent lamps at a level of 50 foot-candles. Incandescent fixtures with red lamps on separate switching shall be placed near each fluorescent lamp in the Control Room and on exterior walls of entrance. Exterior lighting shall be provided with separate switching located near points of egress.

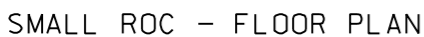
The emergency electrical system shall comply with NFPA 70 and NFPA 101. Emergency lighting shall be provided to ensure adequate illumination to egress building in the event of a power outage.

Lightning protection is required for this building in the form of either mast protection or air terminals on the building.

Telephone service is not a requirement for range operations. However, service should be provided to the ROC if it is available in the area.

A fiber optic connection is required between the ROC and the AAR.

Fire protection is not required per fire codes for this building. Consult local Fire Marshall for compliance with local requirements.



SCALE : 1 : 50



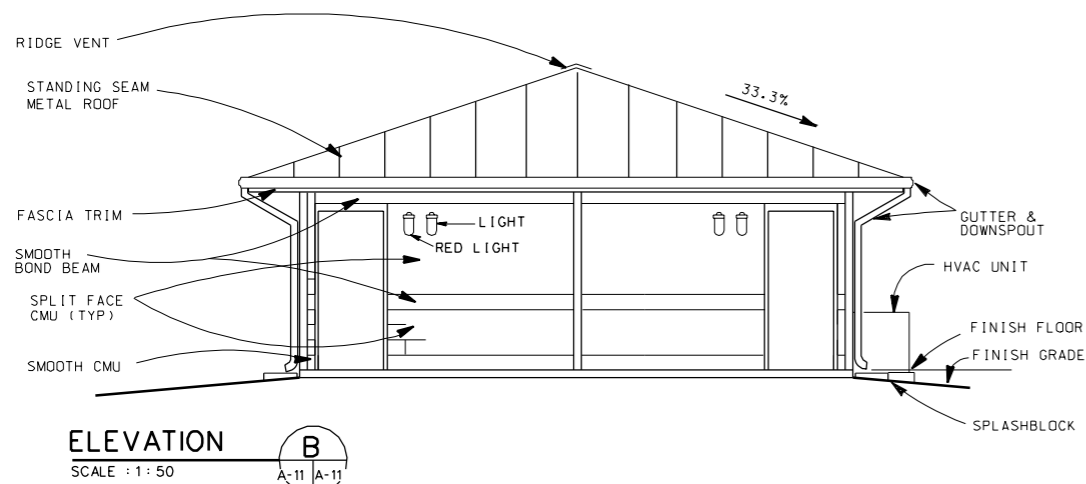
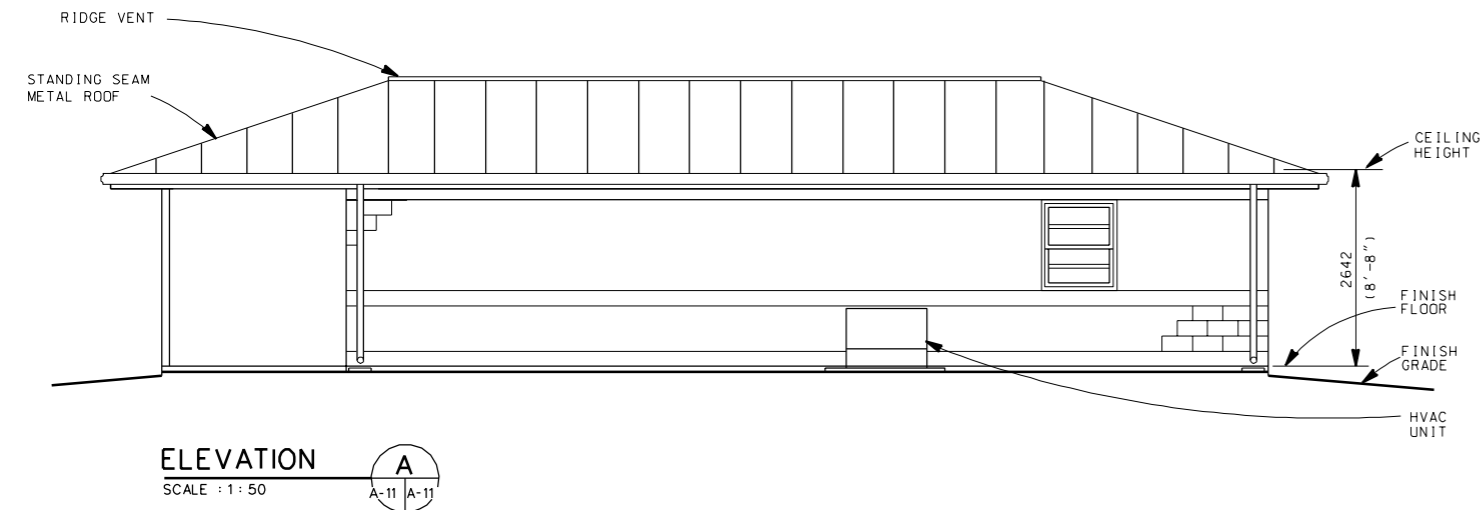
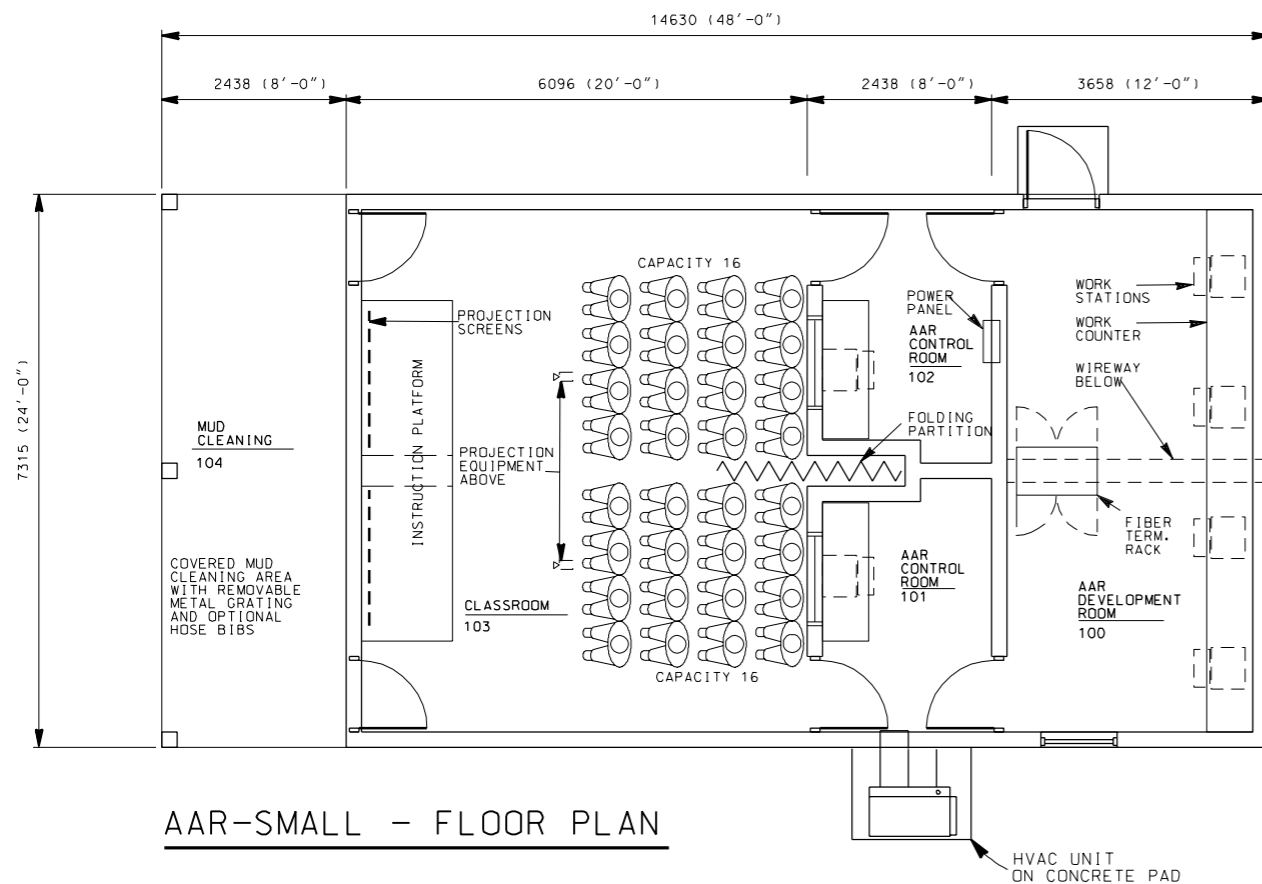
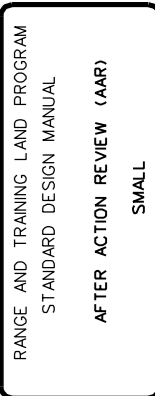
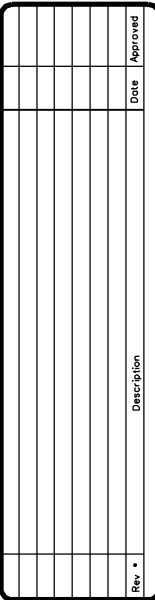
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GRAPHIC SCALES

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GENERAL

The After Action Review (AAR) facility provides space for personnel to review training exercises. Space is also provided for the installation of required electronics and communications equipment to prepare the review presentations and control rooms to monitor the presentations. An optional covered area for gear cleaning can be provided. The facility requires an area of 74.3 square meters (800 square feet). The covered area has an area of 17.8 square meters (192 square feet). The occupant load factor is 9.3 net sq. meters (100 sq. feet) (per person) for the control room and 32 occupants for the classroom based on a business use. See NFPA 101 table 7.3.1.2. All dimensions not labeled are in millimeters.

SITE ADAPTATION

This standard definitive design should be adapted to local conditions such as climate, available construction materials and techniques, topography, seismic zone and the existing character of surrounding buildings. These factors may affect plans, elevations and building systems. The building foundation must be designed based on the results of a geotechnical investigation.

REFERENCE CRITERIA

The design and construction must comply with applicable codes and standards including: technical instruction TI 800-01, "Design Criteria"; Department of the Army regulations, technical manuals, handbooks, standards, and specifications; IBC, NEMA, ANSI, UL, ASTM, and NFPA standards.

FUNCTIONAL REQUIREMENTS

A folding partition is provided in the classroom to provide the option for two smaller classrooms. A work surface is provided for monitors, computers, printers and associated equipment. Where topography allows viewing down range from the control room, windows can be placed above the counter. Windows are double hung to meet functional requirements providing viewing, natural light and ventilation. Windows have forced entry resistant metal frames and are provided with insect screens. Provide polycarbonate security glazing in windows and doors. One way glazing is provided between the control rooms and the classroom. Floors should be sealed concrete or vinyl tile for ease of cleaning, with gyp. board ceilings. Gutters, downspouts and splash blocks should be provided where required by climatic conditions. Covered entries and ice guards may be necessary in northern climates. The AAR is accessed only by able-bodied personnel and does not require ADA compliance unless dictated by local criteria.

MECHANICAL

The Mechanical Equipment shall be selected and sized based on site requirements, local weather design criteria, available energy sources, and building construction materials. The addition of a Mechanical Room may be necessary to accommodate certain types of mechanical equipment. U-Factor requirements are based on the local climatic conditions in accordance with T1 800-1. The mechanical system must maintain an equipment operating temperature of 16 C to 27 C (60 F to 80 F). Route air throughout the building to meet occupant comfort and outdoor air requirements. Provide diffusers and dampers to allow for manual balancing.

ELECTRICAL

The AAR shall be served by 120/240V, 1 phase, 3-wire secondary power. Rigid steel conduit shall extend a minimum of 1524mm (5') outside of the building foundation for power and communication circuits entering and leaving the building. Voltage drop shall comply with standards in NEC and Army technical manuals. Grounding will be installed in accordance with NFPA 70, the NEC, and other applicable standards.

The panelboards shall be recess mounted in finished areas. Receptacles shall be general purpose, 120V, 20A Duplex mounted 450mm (18") above the finished floor. All outlets, receptacles, and conduit shall be recess mounted in finished areas. Provide 120/240V power for the HVAC unit.

Illumination levels will be designed in accordance with IES. Interior lighting shall consist of fluorescent lamps at a level of 50 foot-candles. Incandescent fixtures with red lamps on separate switching shall be placed near each fluorescent lamp in the Control Room and on exterior walls of entrance. Exterior lighting shall be provided with separate switching located near points of egress.

The emergency electrical system shall comply with NFPA 70 and NFPA 101. Emergency lighting shall be provided to ensure adequate illumination to egress building in the event of a power outage.

Lightning protection is required for this building in the form of either mast protection or air terminals on the building.

Telephone service is not a requirement for range operations. However, service should be provided to the AAR if it is available in the area.
A fiber optic connection is required between the AAR and the ROC.

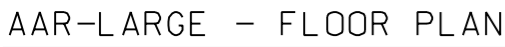
FIRE PROTECTION

FIRE PROTECTION

Fire protection is not required per fire codes for this building. Consult local Fire Marshall for compliance with local requirements.

GRAPHIC SCALES

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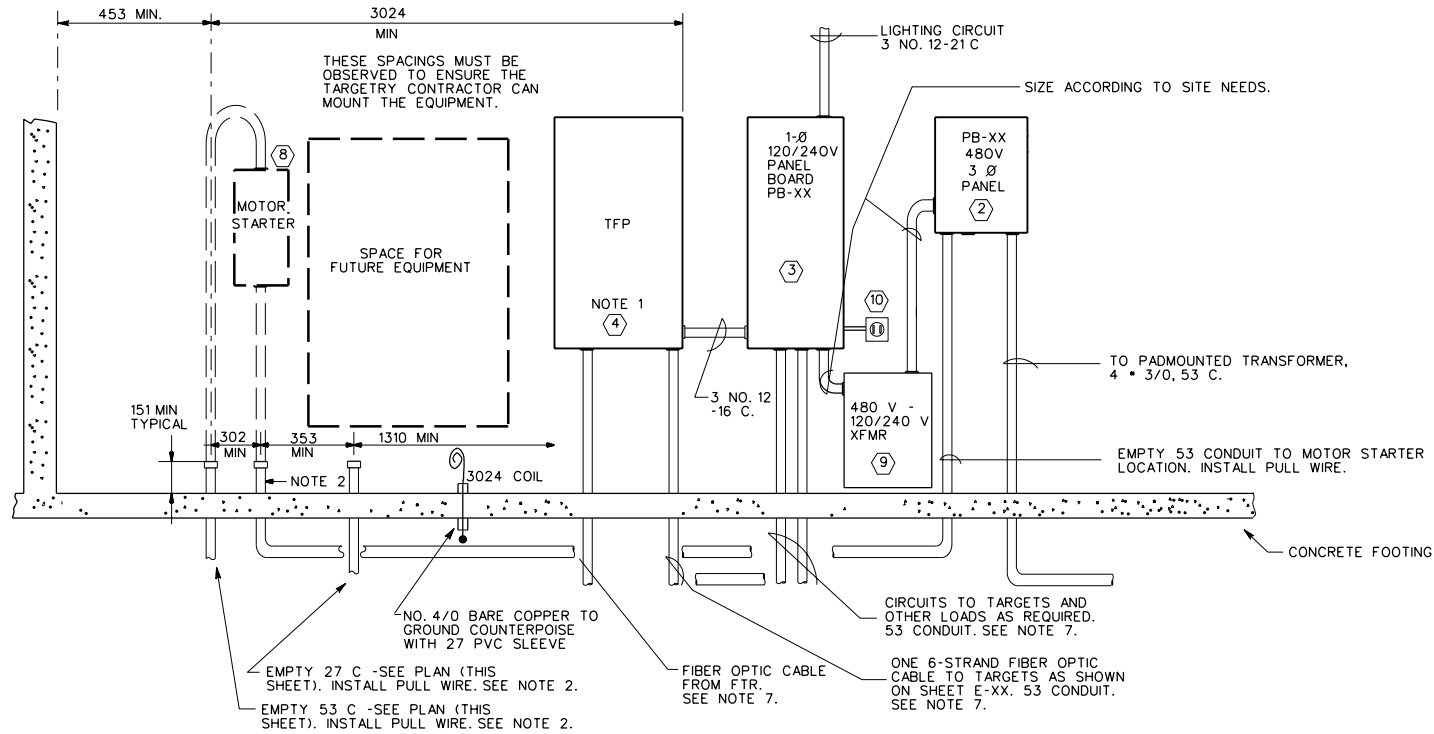


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Fire protection is not required per fire codes for this building. Consult local Fire Marshall for compliance with local requirements.

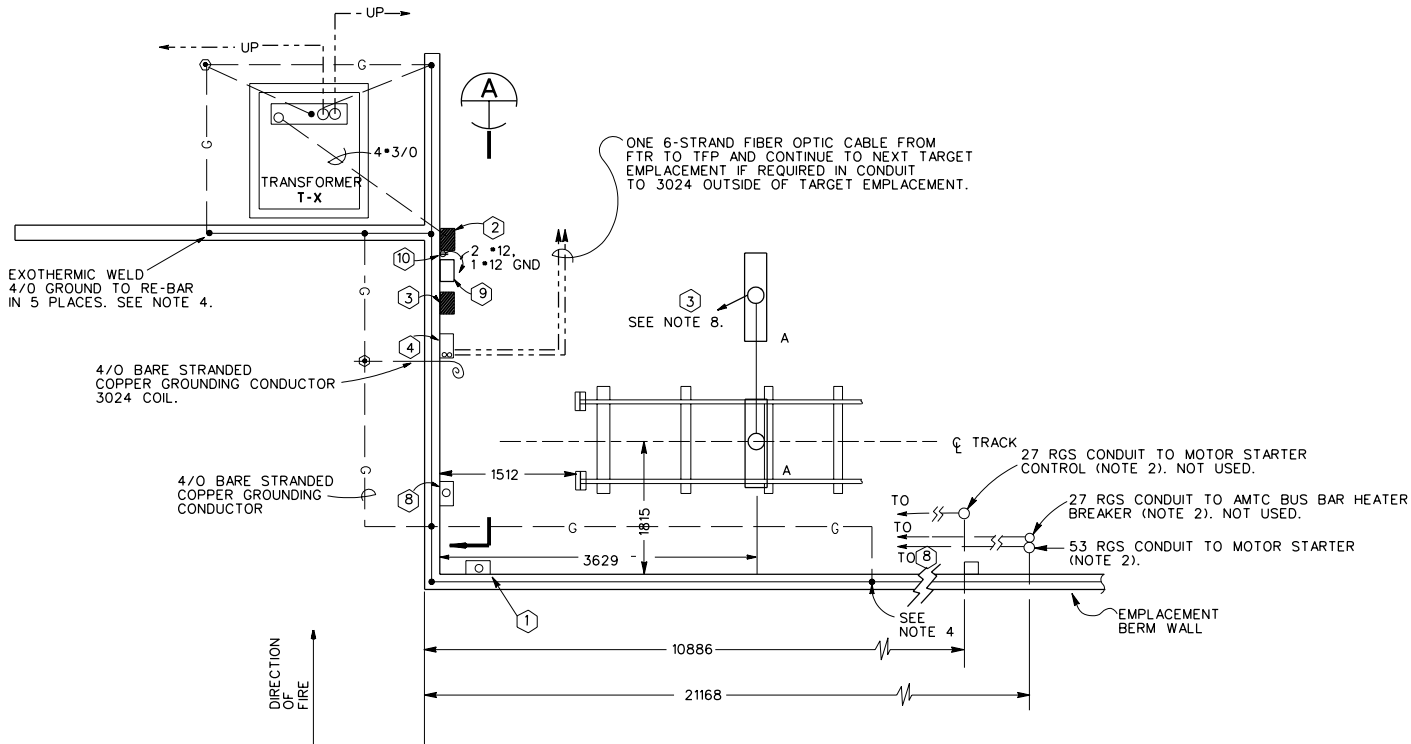




SECTION
N.T.S. A

NOTES:

1. MOUNT TARGET FIBER PANEL (TFP) ON WALL, 454 AFF (TO BOTTOM OF BOX).
2. EXTEND CONDUITS 454 BELOW GRADE OR FINISHED GROUND LEVEL. INSTALL PULL WIRE, AND CAP CONDUITS.
3. DO NOT MOUNT ANY ELECTRICAL PANELS OR JUNCTION BOXES AGAINST CONCRETE. PROVIDE MOUNTING SUPPORTS.
4. BOND GROUNDING CONDUCTORS TO THE REINFORCING BARS IN THE RETAINING WALL AND FOOTINGS.
5. EXTEND CONDUIT 3024 BEYOND TARGET EMPLACEMENT.
6. MAXIMUM MOUNTING HEIGHT FOR ALL EQUIPMENT IS 1361.
7. CONDUITS TO EXTEND TO 3024 OUTSIDE EMPLACEMENTS.
8. NOTE TO DESIGNER: DELETE THESE LIGHTING FIXTURES WHERE NO TARGET SHELTER IS PROVIDED.
9. EQUIPMENT LAYOUT IS MIRROR IMAGE FOR MAT EMPLACEMENTS WITH ORIENTATIONS OPPOSITE THAT SHOWN.



(MAT) POWER CENTER ELECTRICAL PLAN
N.T.S. 1

LEGEND

- ① NOT USED
- ② 480 V, 3-PHASE PANEL
- ③ 120/240 V, 1-PHASE PANELBOARDS
- ④ TFP
- ⑤ NOT USED
- ⑥ NOT USED
- ⑦ NOT USED
- ⑧ MOTOR STARTER (BY OTHERS)
- ⑨ 480 - 120/240V TRANSFORMER
- ⑩ 20 A. RECEPTACLE - 2 *12, 1*12 GND

N.I.C.- NOT IN CONTRACT